



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named
Inventor : Michael J. Peterson

Appln. No.: 09/893,800

Filed : June 28, 2001

For : METHOD AND APPARATUS FOR FLEX
CIRCUIT REFLOW ATTACHMENT

Docket No.: S01.12-0746

Group Art Unit: 2827

Examiner: Ishwar
(I.B.) Patel

RESPONSE

Commissioner for Patents
Washington, D.C. 20231

I HEREBY CERTIFY THAT THIS PAPER IS BEING
SENT BY U.S. MAIL, FIRST CLASS, TO THE
ASSISTANT COMMISSIONER FOR PATENTS,
WASHINGTON, D.C. 20231, THIS

2nd DAY OF January, 2003

Christopher L. Velt
PATENT ATTORNEY

Sir:

This is in response to the Office Action mailed on October 4, 2002. Claims 1-20 were pending in that action. Claim 15 was withdrawn as the result of a provisional election made by Applicant in response to a telephonic restriction requirement. Affirmation of Applicant's election of claims 1-14 and 16-20 is hereby made with traverse. All pending claims were rejected in the Office Action. With this response, all claims remain unchanged.

On page 3 through the top of page 4 of the Office Action, the Examiner objected to Applicant's drawings. With the present response Applicant has included herewith two (2) sheets of corrected drawings that are intended to effectively replace Figs. 3, 4, 5, 7 and 9. Applicant has also included herewith a copy of replacement Figures 3, 4, 5, 7 and 9 with changes generally indicated in red.

Because replacement Figures 3, 4, 5, 7 and 9 include many minor alterations, Applicant will now attempt to summarize the changes made to the original drawings. In all five Figures, the thickness of chip 202 has been increased to accommodate a

clear representation of added cross-hatching therein. In all five Figures, the thickness of connection bumps 218 have been increased to accommodate a clear representation of added cross-hatching therein. In all five Figures, the thickness of cover layer 211 has been increased to accommodate a clear representation of added cross-hatching therein. In all five Figures, the thickness of trace 210 has been increased to accommodate a clear representation of added cross-hatching therein. In all five Figures, the thickness of connection pad 208 has been increased to accommodate a clear representation of added cross-hatching therein. In all five Figures, a cross-hatching indication has been added to flex substrate 204. In all five Figures, the cross-hatching of the solder material (e.g., 304) has been modified to represent a more accurate pattern. In Figure 7, the thickness of barrier strip 602 has been increased to accommodate a clear representation of added cross-hatching therein. In Figures 4, 5, 7 and 9, the indications of distances or heights 404, 504, 704 and 904 have been modified to more accurately reflect a proper indication of a distance or height. In all five Figures, boundary lines have been added around solder material 304 for clarity. In Figure 4, a line was originally unintentionally omitted in association with trace 210; substitute Figure 4 supplies the previously omitted line. Several lines were originally unintentionally omitted in Figure 9 with regard to the traceless pad connection 806 on the left side; new Figure 9 includes the previously omitted lines.

It is respectfully submitted that these substitute drawings remedy the Examiner's objections with regard to Applicant's drawings. In addition, it is respectfully submitted that these substitute drawings remedy several minor errors, thereby making the drawings more clear and accurate. Any additional errors in the drawings were inadvertently made, and Applicant would be happy to entertain additional proposed drawing

changes suggested by the Examiner. Applicant desires the Figures to be as clear and accurate as possible. Applicant respectfully solicits acceptance of replacement Figures 3, 4, 5, 7, and 9.

According to § 2142 of the MPEP, the Examiner bears the initial burden of supporting any prima facie conclusions of obviousness. In order to establish a prima facie case of obviousness in instances where multiple references are cited in combination, the Examiner must show 1) that a suggestion exists for combining the references, and 2) that the combined references teach or suggest all the recited claim limitations. Id. For reasons that will be thoroughly discussed below, it is respectfully submitted that, with regard to all pending claims, the Examiner has failed to support any prima facie conclusion of obviousness.

The present invention generally pertains to a disc drive (e.g., 100) that incorporates a specialized flexible circuit (e.g., 134) for electrically connecting a transducer head (e.g., 122) to a signal-processing component. Applicant's claims generally pertain to different embodiments of flexible circuits that incorporate chip attachment schemes that have been found to enhance the durability of flexible circuits, particularly flexible circuits within disc drives. Applicant has discovered that in the context of disc drives, the particularly durable flex attachment schemes described and claimed in association with the present invention are particularly beneficial because flex circuits incorporated within disc drive applications are commonly required to bend and warp repeatedly during disc drive operation.

On page 4 of the Office Action, the Examiner rejected claims 1, 2, 3, 5-9 and 16-18 under 35 U.S.C. § 103(a) as being unpatentable over Kusui (U.S. Patent No. 6,441,316) in view of Frankeny et al. (U.S. Patent No. 5,065,227), hereinafter referred to as Frankeny.

I. Independent Claim 1

It is respectfully pointed out that neither Kusui nor Frankeny individually provides any disclosure directed to a flex circuit apparatus having a barrier that crosses a trace and is configured to limit a flow of material down the trace so as to limit a collapse of a chip during reflow attachment of the chip to a flex circuit substrate. Presented with the inability of either reference to anticipate the invention of independent claim 1, the Examiner alternatively argues that the teachings of the two references can be combined so as to render obvious the invention of independent claim 1.

Applicant respectfully points out that the "fact that the claimed invention is within the capabilities of one of ordinary skill in the art is not sufficient by itself to establish prima facie obviousness." See § 2143.01 of the MPEP. Even if the references relied upon do, in combination, teach all aspects of the claimed invention, that alone is not sufficient to establish a prima facie case of obviousness without some objective reason to combine the teachings of the references. Ex parte Levengood, 28 USPQ 2d 1300 (Bd. Pat. App. & Inter. 1993).

In the Office Action, the Examiner alleges a particular motivation to combine Kusui and Frankeny. The Examiner essentially states that both rigid and flex circuit boards are known in the art, and that it is known to use a flex circuit board in a semiconductor device. It is respectfully pointed out that these statements only verify that some portions of the claimed invention are within the capabilities of those skilled in the art. As stated above, this is not sufficient by itself to establish prima facie obviousness. In the Office Action, the Examiner also states that it would be obvious to provide the assembly of Kusui with the flexible substrate taught by Frankeny in order to have flexibility either during first installation or

during the life cycle. It is respectfully submitted that this alleged motivation to combine is too speculative to support a denial of patentability in the present case. This alleged motivation to combine is based on assumptions that are opinion-oriented and are not objectively reflected by the record. There is no indication in the Kusui reference of how or why a flexible substrate substitution would or could be beneficial to the Kusui invention.

It is fundamental that rejection under 35 U.S.C. § 103 must be based on evidence comprehended by the language of that section. In re Grasselli, 713 F.2d 731, 739, 218 USPQ 769, 775 (Fed.Cir. 1983) The factual inquiry whether to combine references must be thorough and searching Id. It must be based on objective evidence of record. In re Lee, 61 USPQ2d 1430, 1433 (Fed.Cir. 2002). In the present case, the only conclusion that can be reached from the alleged combinability of the references is the impermissible hindsight gleaned from the present invention. See, e.g., Ex parte Haymond, 41 USPQ2d 1217, 1220 (Bd. Pat. App. & Inter. 1996) (The Examiner "may not, because he doubts that the invention is patentable, resort to speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis.")

Simply stated, the present Office Action does not provide any objective evidence that shows a motivation to combine the Kusui and Frankeny references. Without such objective evidence, no prima facie case of obviousness have been made for independent claim 1. Therefore, the §103 rejection of independent claim 1 was improper.

Further, Applicant respectfully submits that there are unobvious and unexpected results associated with incorporating the attachment scheme described in claim 1 into a flex circuit apparatus for a disc drive. As was discussed above, Applicant has discovered that the claimed attachment scheme enables a disc

drive flex circuit apparatus having an enhanced durability that is particularly beneficial to the high-motion internal environment associated with a disc drive. Applicant has discovered that enhancing the durability of disc drive flex circuits leads to reductions in certain negative influences on disc drive operation. For example, enhanced durability will reduce or eliminate disc drive failures associated with wear and tear on flex circuits within disc drives. Neither Kusui nor Frankeny teach or suggest any benefits to disc drive operation. Therefore, the necessary motivation is lacking and the §103 rejection of independent claim 1 is improper.

In view of these issues, reconsideration and allowance of independent claim 1 are respectfully solicited.

II. Dependent Claims 2, 3, and 5-9

Dependent claims 2, 3, and 5-9 are dependent upon independent claim 1 and were similarly rejected under §103 over Kusui in view of Frankeny. It is respectfully submitted that, for reasons described above in association with claim 1, these dependent claims are patentably distinguishable from the two cited references and are therefore in allowable condition. Reconsideration and allowance of dependent claims 2, 3, and 5-9 are respectfully solicited.

Further, it is respectfully submitted that dependent claims 3 and 5 recite elements that are specifically neither taught nor suggested by the Kusui and Frankeny references. Claims 3 and 5 recite specific distances between a connection pad and a barrier. As the Examiner points out on page 5 of the Office Action, the Kusui reference does not disclose any specific distances between a connection pad and a barrier. It is respectfully pointed out that Frankeny does not teach any barrier at all. From Applicant's perspective, placement of a barrier as

close to a connection pad as is claimed in claims 3 and 5 is extremely unusual, and to Applicant's knowledge, has never been done before. Applicant therefore traverses the notion that it would be obvious to one having ordinary skill in the art to enable the barrier-pad placement relationships described in 3 and 5.

Accordingly, it is respectfully that the cited references considered independently or in combination fail to teach the elements of claims 3 and 5. Although the Examiner did not expressly state so, it would appear that the Examiner is attempting to take Official Notice of the features recited by claims 3 and 5 that are neither taught nor suggested by the cited prior art. Applicant respectfully traverses such action and respectfully requests that the Examiner submit written prior art that teaches or suggests the features of dependent claims 3 and 5 that are neither taught or suggested by the cited prior art. Lacking a showing of such prior art, it is respectfully submitted that dependent claims 3 and 5 are allowable in their present form. Reconsideration and allowance of claims 3 and 5 for this additional reason are respectfully solicited.

III. Independent Claim 16

With regard to independent claim 16, Applicant respectfully submits that proper construction must be done in accordance with 35 U.S.C. §112, paragraph 6. Section 2181 of the MPEP provides guidance with respect to when claim language falls within 35 U.S.C. § 112, paragraph 6. Specifically, the MPEP sets out the following three prong test:

- 1) The claim limitation must use the phrase "means for" or "step for";
- 2) When the "means for" or "step for" must be modified by functional language; and
- 3) The phrase "means for" or "step for" must not be modified by structure, material or acts for achieving the specified function.

Independent claim 16 recites "means for limiting a collapse of the chip during a reflow attachment of the chip to the flex circuit substrate." Applicant respectfully notes that this element is set forth as "means for." Further, the function provided after the preposition "for" requires a prescribed functionality. Therefore, the claimed element recites "means for" as set forth in the first two prongs of the test. Applicant respectfully submits that these two prongs have been satisfied. Applicant respectfully submits that no structure for limiting collapse of a chip during reflow attachment is set forth in independent claim 16 that would preclude applicability of 35 U.S.C. §112, paragraph 6. Thus, Applicant respectfully submits that the third prong of the test has also been satisfied.

35 U.S.C. §112, paragraph 6, states, in part, that a claim containing an element expressed as a means for performing a specified function without recital of structure, "shall be construed to cover the corresponding structure. . . described in

the specification and equivalence thereof." The Federal Circuit has held that means-plus-function language in a claim must be construed according to the specification. See In re Donaldson Company, 29 USPQ2d 1845 (Fed.Cir. 1994). The PTO may not disregard the structure disclosed in the specification corresponding to means-plus-function language when rendering a patentability determination. Id. at 1850. In Donaldson, the Federal Circuit held that §112, paragraph 6 applied to proceedings in the Patent Office. Particularly, the Federal Circuit held that §112, paragraph 6 requires the Patent Office to construe a means-plus-function claim to cover the corresponding structure described in the specification.

In the present case, independent claim 16 recites a flex circuit apparatus that includes means for limiting a collapse of a chip during a reflow attachment of the chip to a flex circuit substrate. The structure of the means for limiting a collapse is described in Applicant's specification at least in Figures 5-9. In addition, the structure is described in the textual portions of Applicant's specification in various locations that support those Figures. One of the structures specifically described in the specification is claimed in Applicant's claim 1. For reasons explained in detail above, Applicant submits that the Kusui and Frankeny references fail to teach or suggest the structural configuration associated with claim 1. It is respectfully submitted that the cited references fail to teach or suggest the invention of independent claim 16, as construed in light of Applicant's specification. Accordingly, reconsideration and allowance of independent claim 16 are respectfully solicited.

IV. Dependent Claims 17 & 18

Dependent claims 17 and 18 are dependent upon independent claim 16 and further define certain aspects thereof. For the same reasons described at least in relation to Fig. 1, it is respectfully submitted that when construed in light of Applicant's specification, claims 17 and 18 are also distinguishable from the cited references. Reconsideration and allowance of claims 17 and 18 are therefore respectfully solicited.

V. Dependent Claims 4, 10-13 & 19

On page 6 of the Office Action, the Examiner rejected claims 4, 10-13, and 19 under 35 U.S.C. § 103(a) as being unpatentable over the combination of Kusui, Frankeny, Takigami (U.S. Patent No. 6,218,630), Shelhorn (U.S. Patent No. 5,001,829), Moore (U.S. Patent No. 5,327,013), and Suzuki (U.S. Patent No. 5,925,445).

Dependent claim 4 depends on independent claim 1. As was discussed above, it is Applicant's position that independent claim 1 is patentably distinguishable from the Kusui and Frankeny references. Applicant further submits that dependent claim 4 is similarly distinguishable from those two cited references. It is respectfully submitted that the other references cited against dependent claim 4 (Takigami, Shelhorn, and Moore) fail to remedy the deficiencies of the Kusui and Frankeny references. It is therefore respectfully submitted that dependent claim 4 is patentable over the references cited against it. Reconsideration and allowance of dependent claim 4 are respectfully solicited.

Dependent claims 10 and 19 recite a "barrier strip" disposed on a surface of a flex circuit substrate so as to limit a flow of material down a trace in order to thereby limit a

collapse of a chip during a reflow attachment of the chip to the flex circuit substrate. In the Office Action, the Examiner points out that Kusui does not teach or suggest the claimed barrier strip. In order to remedy that deficiency, the Examiner cites the Moore and Suzuki references as teaching the element lacked by Kusui.

It is respectfully submitted, however, that the Moore and Suzuki references do not teach or suggest a barrier strip as claimed in dependent claims 10 and 19. The Moore reference teaches a stop 28 formed by a resist material and applied to an integrated circuit die. Stop 28 specifically is not applied to any substrate, let alone a flexible substrate. Accordingly, Moore fails to teach or suggest a selectively deposited barrier strip disposed on a flex circuit substrate, as is claimed in claims 10 and 19.

The Suzuki reference teaches insulation films 4B and 4C that are configured to dam a stream of sealing resin 10 from flowing out of two internal zones and into an external zone. As is illustrated in Figure 4A, chip 8 will remain at the same height regardless of the flow of resin 10. Further, sealing resin 10 is not a reflowable solder material. Therefore, insulation films 4B and 4C are not selectively deposited barrier strips configured to limit a collapse of a chip during reflow attachment of the chip to the substrate, as is recited in each of claims 10 and 19.

Accordingly, the features of claims 10 and 19 are simply neither taught nor suggested by the cited references. Accordingly, reconsideration and allowance of dependent claims 10 and 19 are respectfully solicited.

Dependent claims 11 and 12 are dependent upon dependent claim 10. Dependent claims 11 and 12 recite specific constructions for the barrier strips claimed in dependent claim 10. As was mentioned with reference to dependent claim 10, it is

respectfully submitted that the Examiner has failed to cite references that teach or suggest the recited barrier strips. It is therefore respectfully submitted that dependent claims 11 and 12 are allowable at least for their dependency on claim 10. Reconsideration and allowance of claims 11 and 12 are respectfully solicited.

Dependent claim 13 recites a barrier strip similar to dependent claims 10 and 19. The barrier strip recited in dependent claim 13 is disposed within a cover layer open area. As the Examiner points out on page 7 of the Office Action, the Kusui reference does not disclose a barrier formed by a barrier strip disposed on the operating surface of a flex circuit substrate. However, on page 9 of the Office Action, the Examiner claims that the Kusui reference indeed does disclose a barrier strip located within a cover layer open area. It is respectfully submitted that the Kusui reference fails to teach or suggest any barrier strip. It is further submitted that the Suzuki and Moore references fail to teach the barrier strip of claim 13 for the same reasons that those references failed to teach the barrier strip recited in claims 10 and 19. Therefore, reconsideration and allowance of dependent claim 13 are respectfully solicited.

VI. Dependent Claims 14 & 20

On page 9 of the Office Action, the Examiner rejected claims 14 and 20 under 35 U.S.C. §103(a) as being unpatentable over Kusui, Frankeny, and Kondo et al. (U.S. Patent No. 6,303,878), hereinafter Kondo.

Claims 14 and 20 are dependent upon independent claim 1 and independent claim 16 respectively. For reasons described above in association with their respective independent claims, Applicant submits that dependent claims 14 and 20 are patentably distinguishable from the Kusui and Frankeny references. It is

respectfully submitted that the Kondo reference does not remedy the deficiencies of the Kusui and Frankeny references. Accordingly, reconsideration and allowance of dependent claims 14 and 20 are respectfully solicited.

VII. Conclusion

In conclusion, Applicant submits that independent claims 1 and 16 are allowable over the references cited by the Examiner. Applicant also submits that dependent claims 2-14 and 17-20 are also allowable. Reconsideration and allowance of all pending claims 1-14 and 16-20 are respectfully solicited.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

WESTMAN, CHAMPLIN & KELLY, P.A.

By: Christopher L. Holt
Christopher L. Holt, Reg. No. 45,844
Suite 1600 - International Centre
900 Second Avenue South
Minneapolis, Minnesota 55402-3319
Phone: (612) 334-3222 Fax: (612) 334-3312

CLH/rkp